Załącznik Nr 2 do wniosku o wszczęcie postępowania o nadanie stopnia doktora

Summary of PhD Thesis

In the PhD Thesis, the Atomic Layer Deposition (ALD) process of TiO_2 was proposed for surface modification of 316LVM steel intended for blood contacting implants. The stainless steel substrate was subjected to electropolishing, chemical passivation, ALD process and steam sterilization.

The mechanical and physicochemical properties of the thin films were checked for specimens prepared in 500 ALD cycles in temperatures 100, 200, 300 and 400°C.

The following properties of the thin films were investigated: chemical composition, coating adhesion, surface wettability, surface topography, pitting and crevice corrosion resistance, penetration of metal ions into the artificial plasma, layer thickness. The best set of physicochemical and mechanical properties were obtained for deposition temperature 200°C.

The samples with the best set of physicochemical properties were subject to deformation susceptibility tests, microstructure examination and biological tests, such as: cytotoxicity assay in direct contact, cell proliferation assay, thrombogenicity in dynamic conditions, hemolysis assay in dynamic conditions, testing the level of pro-inflammatory cytokines.

The proposed surface modification improved the corrosion resistance of the substrate, reduced the penetration of metal ions into the artificial plasma, changed the surface wettability into hydrophobic one (preferable for blood contacting surfaces), in in vitro tests: improved cell viability, did not cause thrombogenicity, hemolysis, inflammatory response. The research results confirm the thesis presented in this work and thus prove the positive influence of the proposed surface modification on its biological properties. As the biocompatibility of cardiovascular implants depends on the device characteristics, further research plan must be developed, depending on the application.